

# FLIGHT

The  
AIRCRAFT  
ENGINEER  
&  
AIRSHIPS

First Aero Weekly in the World.

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport  
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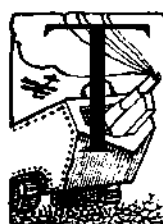
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### INDEX FOR VOL. XIII.

The Index for Vol. XIII of FLIGHT (January to December, 1921) is now ready, and can be obtained from the Publishers, 36, Great Queen Street, Kingsway, W.C. 2. Price 1s. per copy. (1s. 1d. post free).

### EDITORIAL COMMENT



#### Our Future in the Air

THE series of articles in *The Times* by Brig.-Gen. Groves, under the title "Our Future in the Air," which should be read by all who have the welfare of the Empire at heart, have aroused an interest so widespread as to rivet the attention not only of all sections of the community at home, but, without doubt, also the majority of European nations. For sheer logic of argument and lucidity of exposition the articles have never been surpassed in any debate on questions of air policy, and had it been at all possible to do so we should have liked to publish them in full. That, however, is entirely out of the question, and we must perforce confine ourselves by referring to Gen. Groves' main points.

Broadly speaking, the argument advanced by Gen. Groves is that there is one way, and one way only, in which the Empire can safeguard itself against attack from the air: by the establishment and maintenance of an offensive-defensive long-distance "striking force" which shall be capable of attacking the centres of any potential invader and paralyse him before he has had time to get ready to attack us. This "striking force," it is contended, must consist of bombers drawn from a subsidised, organised and well-developed Civil Aviation, protected by the fighting machines of the R.A.F.

Gen. Groves calls attention to the way in which Germany, handicapped as she has been since the War, is building up, or preparing to build up, air power under the guise of Civil Aviation, and points out that France has good cause for anxiety, and is well justified in developing by all means her air power. He proves that aerial preparedness on any other basis than that of a "striking force," the main body of which is fed by Civil Aviation, is quite impracticable, and would involve the expenditure of absurd sums of money and the maintenance of huge personnel.

### DIARY OF FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list:

1922.

Mar. 26-

April 2 Nice Meeting

Mar. 30 .... Lecture, "The Design of a Commercial Aeroplane," by Capt. de Havilland, before R.Ae.S.

Mar. 31 .... Lecture, "Aircraft Design" by H. P. Folland, before I.Ae.E.

April 7 .... Lecture, "Some Outstanding Problems in Aeronautics," by Professor L. Bairstow, before Students' Section, R.Ae.S.

April 17 .... R.Ae.C. Race Meeting, at Waddon

April 17-19 Seaplane Contest, Marseilles

June 1 .... Entries close for Schneider Cup Race

June 5 .... R.Ae.C. Easter Race Meeting, at Waddon

June 23-25 International Competition for Touring Aeroplanes, Brussels

July 6-20 French Gliding Competition

Aug. 6 .... Gordon-Bennett Balloon Race, Geneva

Aug. 7 .... R.Ae.C. Race Meeting, at Waddon

Aug. (last fortnight) Schneider Cup Seaplane Race, at Naples

Sept. .... Tyrrhenian Cup, Italy

Sept. .... Italian Grand Prix

Sept. or Oct. R.Ae.C. Race Meeting, at Waddon

Sept. 22 ... Coupe Deutsche (300 kil.)

In connection with the possibility of converting commercial aeroplanes into bombers, Gen. Groves calls attention to the paradoxical attitude of our Government, which, while agreeing with our Allies that German Civil Aviation may constitute a danger, owing to the possibility of converting machines for military purposes, yet refuses to admit that British Civil Aviation is, or would be if it existed, of any military value in the event of a war. This in spite of recommendations made by the Civil Aerial Transport Committee and other representative bodies. Instead of fostering Civil Aviation, the Government, as represented by the Air Ministry, has pursued an archaic militarist policy which has virtually ruined the aircraft industry.

The arguments advanced by Gen. Groves, in the main the same as have been put forward in *FLIGHT* for the past three or four years, maintain that Civil Aviation is not a form of locomotion which must stand or fall by its commercial success, but is rather to be looked upon as a form of national insurance. It is no manner of use saying that we cannot afford Civil Aviation. Looked upon from our point of view, and that of Gen. Groves, we simply cannot afford, if only from the mere self-preservation point of view, not to develop it. The maintenance of an Air Force of sufficient proportions adequately to meet the requirements of the units co-operating with the Army and Navy, for home defence, for "policing" in the East, etc., would at present, for reasons of economy, be out of the question. By making a better and fuller use of Civil Aviation this expense could be greatly reduced, while at the same time giving all the advantages of the most rapid means of communication. The result of this failure on the part of the Government to recognise the potential value of Civil Aviation has been that the Navy will find itself in a serious position owing to lack of squadrons for naval duties, while in the case of the Army the position is very nearly as bad.

### The Remedy

Having outlined the present unsatisfactory position, Gen. Groves proceeds to summarise what, in his opinion, is the course we must adopt in order to secure an adequate defence against invasion by air. The aims of British air policy, Gen. Groves states, should be:—

1. First and foremost, to build up as rapidly as possible and in the most economical manner a Striking Air Force for home defence. If this is not done the heart of the Empire, England itself, will be open to sudden direct attack from the air.
2. To provide the Navy and Army with the specialised air forces essential to their efficiency.
3. To create a Royal Air Force organisation to carry out duties at present performed by the two other Services where such duties can be effectively and more economically so performed.
4. Last, but not least, to maintain and develop the aircraft industry. This will be secured automatically if the above specified aims are achieved.

The only possible method for us to create and maintain a defensive air fleet is by making use of Civil Aviation, by subsidies if necessary, and to organise and develop it in such a manner that the

bulk of the *personnel* and *matériel* shall be instantly available in the case of a war. Gen. Groves suggests that, in addition to the escorting fighting machines, which are specialised aircraft to be developed by the R.A.F., the squadrons of converted civil bombers should be led by "Service Bombers" acting as formation leaders.

As regards the question of administration, Gen. Groves emphasises that unless there is the closest co-operation between the Service and Civil departments of the Air Ministry the policy outlined obviously cannot be realised. At the present moment it is no secret that this co-operation does not exist. We therefore cordially endorse the suggestion that it would be well to have Civil Aviation more strongly represented on the Air Council, and this might be done by placing it, as Gen. Groves says, "under the wing of the Under-Secretary of State for Air." There would then be two members of the Air Council responsible for Civil Aviation, one politically and the other administratively.

No less important is the question of Air Force units required for tactical co-operation with the Army and Navy, and we entirely commend the suggestion of Gen. Groves that, failing a Ministry of Defence, it might be advisable to add to the Air Council, as *ex officio* members, a representative from the Admiralty and one from the War Office. We are quite certain that both Navy and Army fully realise the vital importance of the air to their Services, and the inclusion of representatives on the Air Council should go a long way towards establishing better relations. The proposed reductions in the squadrons allotted for co-operation with the Navy and Army cannot but be felt to a very great extent by these Services, and the gain which it is expected to realise thereby—three squadrons for home defence—is extremely small. As a matter of fact, regarded as anything beyond a mere nucleus, three squadrons for home defence are totally inadequate.

In conclusion, Gen. Groves claims as an essential that, in view of the fact that our first line of defence is now the R.A.F., the post of Air Minister should be held by a statesman of Cabinet rank. We hardly think anyone will seriously quarrel with that contention, as it follows as a logical corollary of the paramount importance which the air is assuming, indeed already has assumed.

As we have already stated, the views expressed by Gen. Groves have, for the greater part, been voiced in these columns time after time, and it is therefore with the deepest satisfaction that we welcome his extremely valuable contribution to the discussion of our air policy. He has made many very frank statements, but he has not, we think, put forward a single one which cannot be justified or has already been substantiated. His reasoning is so logical that his arguments are incontrovertible, and it is sincerely to be hoped that his timely warning will be taken to heart before it is too late. To quote his own words, "Let the leaders of light and learning in this sphere not forget that, in accordance with the teaching of history, those who cease to learn fail to lead."

### China's Air Service Wilting

CHINESE "finance" was ever a thing to be marvelled at, and one of the latest enterprises to suffer at its hands appears to be the Air Service which was inaugurated last year under such favourable auspices with the assistance of Messrs. Vickers, Ltd. It seems that the cash provided,

which should have gone to run the service to a commercial success, has filtered away through the Government inaptitude until nothing remains for wages, coupon interest, or anything else—without some financial miracle happens. From latest reports it looks as if the whole scheme may easily become another monument to Chinese methods of how not to do it



# THE D.H. TYPE 34 COMMERCIAL BIPLANE

## First Machines Ready

IN our issue of January 5, 1922, we published general arrangement drawings and a brief preliminary description of the D.H.34 biplane, Napier "Lion" engine, then in course of construction at the Stag Lane Works, Edgware, of the de Havilland Aircraft Co., and promised to give further particulars and illustrations when the machines were completed. This week we are able to fulfil our promise, and some of the more interesting and novel details of the 34 are illustrated in the accompanying sketches. For the use of the photographs we are indebted to the Daimler Airway, for whom the first of the machines to be finished are intended. Quite a number of 34's are coming through the works, and

introducing such improvements in construction and fitting-out as have been shown in practice to be desirable, or which have been asked for by the operational firms who are to use the machines. There is every appearance in these machines of the closest co-operation between constructor and user, and the result cannot fail to be a considerable improvement. In the past the constructor has been handicapped by not knowing exactly what the user wants, while the user, on the other hand, has found fault with certain features of machines, which were due to the lack of realisation of his requirements on the part of the constructor. It is quite evident that only by close co-operation can we hope to attain



THE D.H. 34 : Front view. Note petrol tanks under top plane.

on our visit last week we inspected several in the new buildings recently erected at Stag Lane. Some of these machines are painted all over in "pillar-box" red, this being the colour chosen by Daimler Airway for their machines. Others are painted the particular blue which one associates with the Instone Air Line, and it was learned that these were, as a matter of fact, being built for that firm. With such up-to-date flying stock, the air lines should do good business during the coming season, and already there are indications of considerable competition, which, we are always being told, is good for trade.

The D.H.34 resembles, as regards outward appearances, the famous "18's," which have done such good work on the London-Paris services for a couple of years now, and we understand that, as a matter of fact, it has been the aim of the designers to retain the aerodynamical features of the 18, which were found excellent, while at the same time

success, and, as already stated, the D.H.34 bears traces of such co-operation. This is highly gratifying, and is decidedly a step in the right direction.

While thus retaining the good aerodynamical features of the 18, the D.H.34 is, in reality, quite different as regards its construction and also, to a certain extent, in the manner in which component weights are disposed. The most notable departure in this respect is the placing of the pilot in front of the wings, instead of far aft in the fuselage, behind the cabin, as he was in the 18. There are, we believe, several reasons for this innovation. To begin with, the cabin is considerably larger than that of the 18, and even if shifted forward it would have brought the pilot very far back. Also, the forward position of the pilot will probably result in a better view, although this is, perhaps, open to discussion. In the 34 the pilot has an excellent view on one side, but the engine certainly appears to restrict the



THE D.H. 34 : Three-quarter front view.



THE D.H. 34 : View inside cabin, looking aft.

view forward, and to the other side. However, most pilots would probably prefer the forward placing of the seat, although after being used to the 18's, the change must appear somewhat bewildering at first. One advantage of the present arrangement is that the cabin is well separated from the engine, not only by two bulkheads but also by the space occupied by the pilot's cockpit. As very long exhaust pipes are fitted, there should be comparatively little noise in the cabin, and we understand that, as a matter of fact, it is quite easy to converse during the journey.

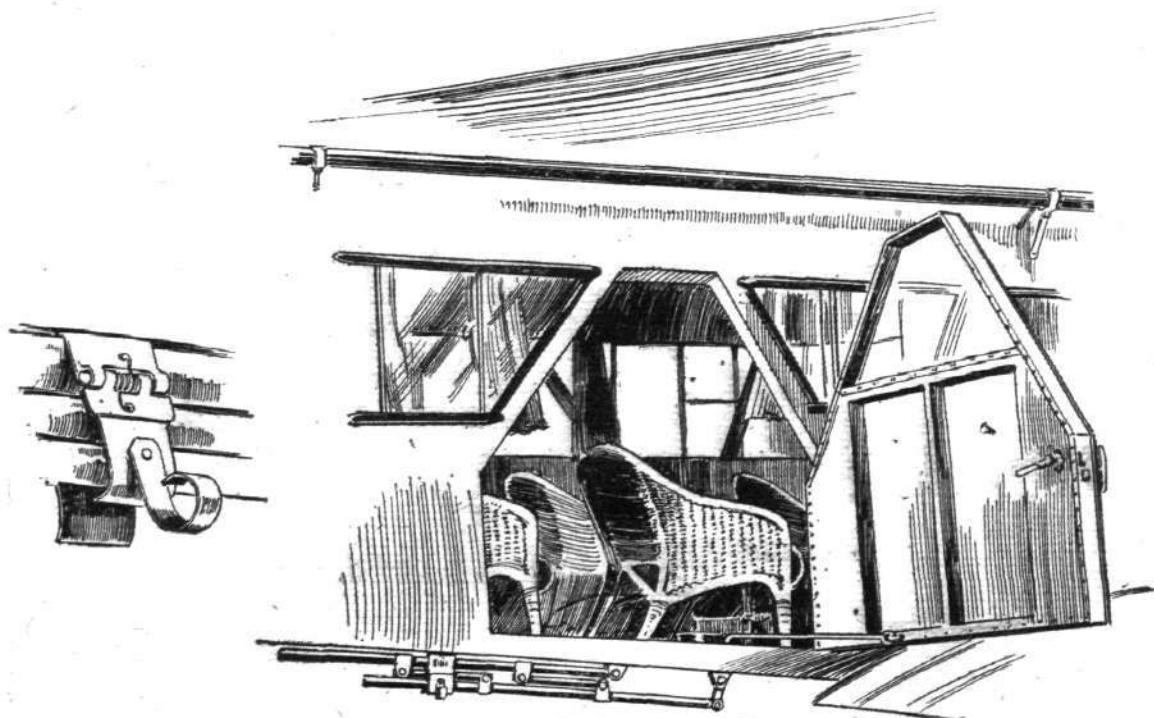
As regards construction, the 34 differs from the 18 mainly in the manner of building up the *fuselage*, the whole of which in the 34 is built up of triangulated struts, the framework

being covered throughout with three-ply wood. This form of construction has been found in practice to stand up well to wear and tear, and to require little or no attention beyond the usual cleaning of the cabin. With a wire braced structure there is always the possibility of wires stretching and necessitating trueing-up. In the construction of the wings there is less change, the general design of spars, ribs, and fittings being similar to that of the 18 wings, although the dimensions are somewhat different, the wing section not being the same as that of the 18.

The undercarriage is similar to that of the 18, or rather to its later version as exemplified in the 29 monoplane. It consists of two simple Vees, of which the front legs are rigid while the rear are telescopic and provided with rubber shock absorbers and oleo damping gear. A feature of this undercarriage is its great resiliency, and its height which brings the machine down at a large angle of incidence when the tail skid is on the ground, thus enabling it (the machine, not the ground) to be pulled up very quickly on landing. While on the subject of undercarriages, it might be mentioned that the very substantial tail skid, the details of which are shown in some of our sketches, is provided with an easily renewable cast-iron shoe, so that replacements can be easily and quickly carried out. At the same time, a cast-iron shoe is cheap to manufacture, and its frequent renewal is not a large item in the expense sheet.

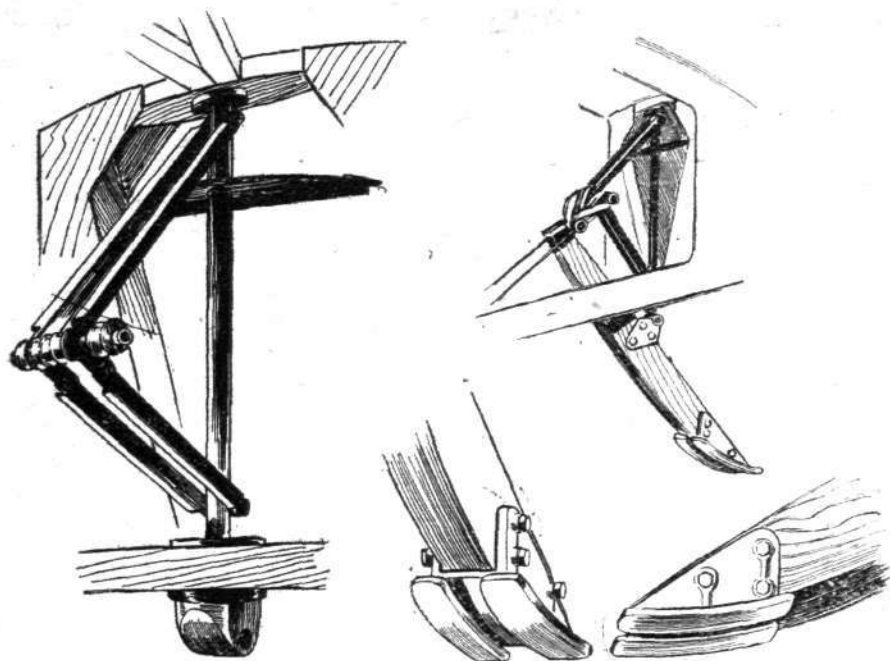
As in the 18, and 29 monoplane, the Napier "Lion" engine is mounted as a separate unit, attached to the main *fuselage* structure by four bolts, and separated from the pilot's cockpit by a fireproof bulkhead. The underslung radiator is cowled-in, but swivelling slats in the front of the cowl allow of varying the amount of air admitted, the air escaping through an opening under the bottom of the *fuselage*. One advantage of this placing of the radiator, quite apart from any question of cooling, is that it can be removed without interfering with the propeller, whereas a nose radiator usually necessitates taking the propeller off in order to remove the radiator.

The general appearance of the D.H. 34 is well shown in the accompanying photographs. One of these shows the cabin, which has seating accommodation for nine passengers. The seats are of the wicker-work type, having their legs resting in sockets in the floor, and being secured by leather straps, which prevent the legs from coming out of the sockets. At the same time, all the chairs can be easily removed, should it be desired to use the machine for goods or other cargo. As a result of practical experience, it has been found that it is often desirable to be able to transport a spare engine from Paris to London, or *vice versa*, and consequently provision has been made for allowing this to be done. The cabin door, which is on the starboard side, is of a peculiar shape, and just allows of passing a Napier "Lion" through. Owing to the insufficient width of the cabin it is not, however, possible to turn the engine unless the two rear cylinders are removed first. In order to avoid the necessity for doing this, a circular opening has been cut in the port side of the cabin wall, through which the propeller



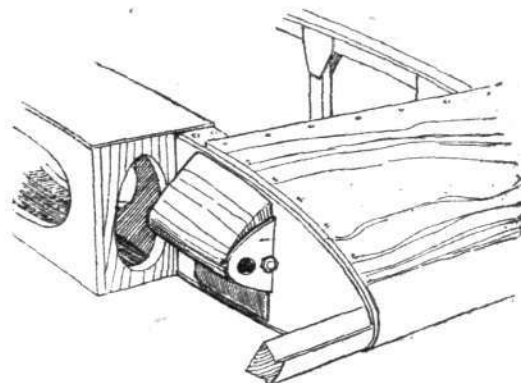
The D.H. 34 : Sketch showing door of cabin, and folding ladder by means of which passengers enter. Inset shows the small spring clip which locks ladder in position when folded.





The D.H. 34 : Some details of the very substantial tail skid. This is of the steerable type, and consequently the point of attachment of the rubber shock absorbers swivels with the skid. The shoe is of cast iron, and is easily renewable.

to get the cabin as light as possible, additional fabric-covered, roof lights are provided. Some of these also serve as emergency exits. For night flying the machine is thoroughly equipped, not only as regards lighting the cabin itself, but also with the necessary navigation lights, Holt flares under the wings, etc. The power for the lighting is obtained from a dynamo driven by the engine, a special gear-box having been provided, with a short shaft running through the engine bulkhead to the



The D.H.34 : Some details at the root of the lower plane.

boss and a small portion of the forward part of the crank-case can pass, thus allowing of swinging the engine round.

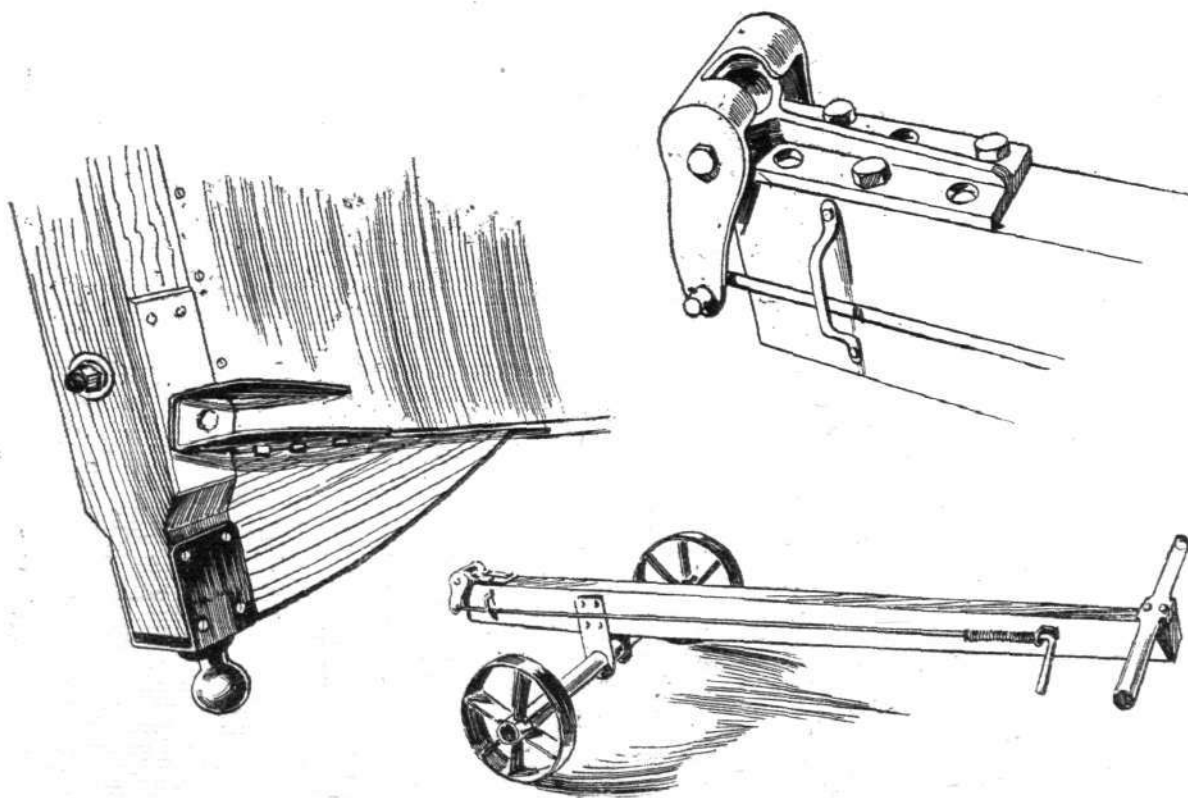
The cabin itself is very roomy, there being about 7 ft. head room in the centre. Provision has been made for heating and ventilation. The former is effected by hot air from a muff around the exhaust pipe on the starboard side, led to perforated boards under the floor, *via* a diffuser box having a movable flap by means of which the amount of air can be regulated by the passengers themselves. Cold air is passed to this box from a trumpet projecting through the roof of the cabin just aft of the pilot's cockpit, and the regulator is so connected up that at the same time as the hot air is admitted the cold air is cut off, or *vice versa*. In this manner it is hoped that an agreeable temperature may always be maintained without giving a draught. The foul air is sucked out of the cabin by louvres in the roof.

In addition to the question of ventilation and heating, the problem of lighting has also received attention. The windows in the side give a fair amount of light, but in order

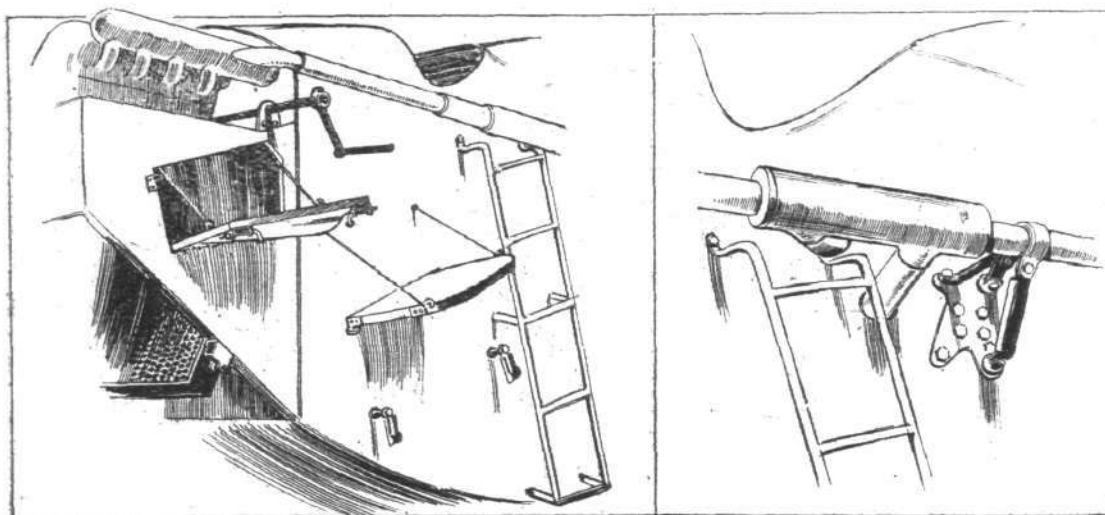
dynamo placed on a shelf to the right of the pilot. The current for the wireless outfit is obtained from a wind-mill driven generator, mounted on a shelf on the port side of the machine.

As regards instruments, etc., the 34 is very well equipped, and in fact it probably carries a more complete set than any machine at present in use. The pilot has a good deal to look after, and there is little fear of him getting bored on a trip, what with flying the machine, keeping his course, watching a number of dials, etc. In his cockpit there is a seat for an engineer, navigator, or any passenger who prefers to travel "outside." Probably for the London-Paris service it will not be necessary to carry a navigator, and presumably the spare seat in this cockpit will usually be occupied by a passenger.

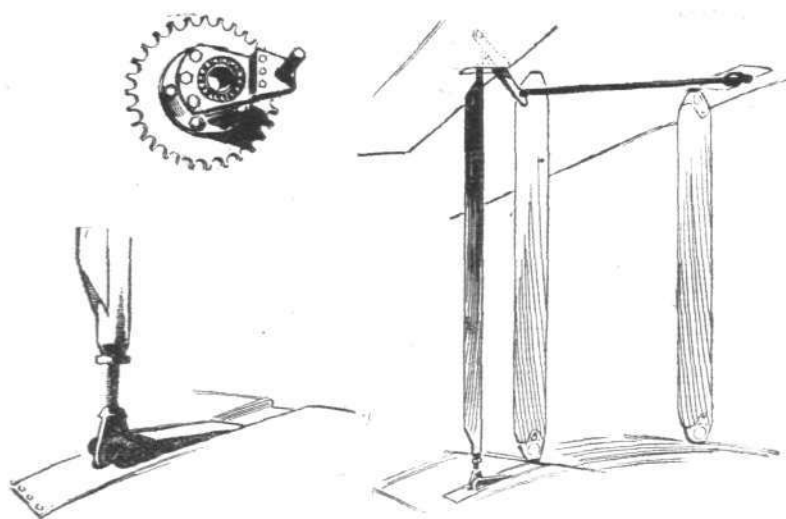
A great deal of attention has been given to such items as affect the running of the machine in actual service. For instance, the doors in the engine housing have been so designed that they hinge so as to project horizontally, being supported when in this position by cables. They thus form platforms



The D.H.34 : Sketch showing details of the trolley used for supporting the tail when wheeling the machine about on the ground. The ball on the stern post rests in the socket on the trolley, where it is locked in position.



The D.H.34 : The sketch on the left shows the folding platform and engine starting handle, and also the ladder leading up to the pilot's cockpit. On the right is the muff around the exhaust pipe from which the cabin is heated. Note the swivelling bracket, which allows the exhaust pipe to expand.



The D.H. 34 : Some details of the ailerons control system. In the top left-hand corner may be seen the small crank arm, working on ball bearings, which is operated from the control stick via rods and chain. The aileron strut is adjustable for length.

on which mechanics can stand while making adjustments to the engine. The value of this in the case of a forced landing will be apparent. Normally, without these platforms, it would be a matter of the greatest difficulty for the pilot or engineer to reach, for example, the sparking plugs, assuming that the machine had been forced down by sooted plugs. With the platforms it is an easy matter to get at any part of the engine, even when no steps or other appliances external to the machine are available.

The Napier "Lion" is started by means of a starting handle on the port side, and a platform, which folds flat against the side of the fuselage when not in use, is provided for the engineer to stand on. Thus the antiquated method of swinging the propeller is to be done away with entirely. It is features such as these, which may seem but small items in themselves, which make for smooth working, and we think that this is really the first time we have seen such subjects

seriously considered. In the past there has been too much tendency to let the mechanics scramble about on machines as best they might, providing, in the best of cases, a step on a strut or a foot plate on a wing. We therefore, welcome these improvements as a sign of that co-operation between constructor and user to which we have already referred.

The petrol system comprises two tanks, mounted some distance out, under the top plane. Their height is not sufficient to give direct gravity feed, but a low-pressure pump, delivering petrol through Blaisdell "Petro-Flex," should not be a source of any trouble, even if one might have preferred to see direct gravity feed incorporated. On the front of each petrol tank is a level gauge, which can be easily read from the pilot's seat.

The controls are of the usual type, except that several features from the D.H. monoplane have been incorporated. Thus all controls and control surfaces work in ball bearings, and the use of cables is reduced to a minimum. Wherever cables have to be guided, a short length of metal rod is incorporated, passing through a guide of large area, so that there should be no question of cables wearing out. The system of differential movement of ailerons, first tested in the monoplane, has been incorporated in the 34. Short crank arms, working in ball bearings, are housed in the top plane under the front spars. From these, tubes run to the upper aileron king posts, while struts connect upper and lower ailerons. In the aileron control system there should be no question of cable stretch and but little adjustment be required, although provision has been made for adjustment of the length of the aileron struts if necessary.

We are informed that the first of the 34's was tested on Sunday, March 26, and was found to handle very well indeed, Mr. Cobham being, we believe, the pilot. Following are the main characteristics of the D.H.34 :—Length, 39 ft. ; span, 51 ft. ; height, 12 ft. ; wing area, 590 sq. ft. ; weight of machine empty, 3,365 lbs. ; useful load, 10 passengers with luggage, or about 2,000 lbs. ; total loaded weight, about 6,300 lbs. ; power loading, 13.8 lbs./h.p. ; wing loading, 10.5 lbs./sq. ft. ; cruising speed about 105 m.p.h. ; range, 3½ hours at cruising speed.

As already mentioned, the first of the 34's are to be put on the London-Paris service by Daimler Airway, while others are to be used by the Instone Air Line on the same route. The machines should prove a distinct improvement on the 18, although that machine has an excellent record, and we think that with the D.H.34, one more step has been made towards the ideal commercial aeroplane.

## Policing Iraq by Aircraft

SIR PERCY COX, High Commissioner of Iraq, made his first inspection by air of part of the country lying along the Euphrates on March 21, when he visited Fahad Beg Ibn Hadhdhal, Sheikh of Amarat, at his headquarters, about 30 miles N.W. of Hit. He was accompanied by his staff and a Royal Air Force guard of honour.

The party, we learn officially, left Baghdad in three Vickers "Vernon" machines, one of which also carried stores for armoured cars, with an air escort of 12 machines.

The Amarat, who are well armed and number 5,000 rifles, range the eastern half of the Hamad as far north as Dair az Zaur. The tribe is regarded as friendly to the British. The effect of the visit and the demonstration of air power by the assembled aircraft, and of machine-gun fire by

armoured cars, which were also present, is reported to have been very impressive. The flight, which covered about 300 miles out and home, partly following the course of the Baghdad-Cairo air line, was accomplished successfully on the day of the inspection, by the 15 machines engaged.

The Vickers "Vernon" machines which were used for conveying the official party are twin-engined troop-carrying aeroplanes that have been sent recently to Iraq to augment the air units stationed there, and are destined to take an important part in the garrisoning of this vast territory when it comes entirely under Royal Air Force control.

The machine is capable of carrying a load of nearly two tons, and can accommodate 12 persons, with full military equipment, in addition to the pilots, water, and food supplies.



## THE 1,000 H.P. NAPIER AERO ENGINE

### Some Additional Particulars

IN our issue of February 23, 1922, we published a brief description of the 1,000 h.p. Napier aero engine, nicknamed the "Cub." We are now able to give a few further particulars, although a very detailed description is not yet permitted by the Air Ministry. The "Cub," it will be remembered, has 16 cylinders, arranged in four banks of four each, somewhat in the formation of a letter X, although the angles between the cylinder banks are not the same at the top as at the bottom. The bore of the cylinders is  $6\frac{1}{4}$  ins., and the stroke  $7\frac{1}{2}$  ins. The normal brake horse-power of 1,000 h.p. is developed at a speed of 1,800 r.p.m. The total swept volume of the engine is 3,681.6 cubic ins., and the compression ratio is 5.2 to 1. A spur gearing reduction gear brings the speed of the propeller down to 752 r.p.m., which allows of a large diameter efficient propeller being fitted.

The direction of rotation of the engine is anti-clockwise, viewed from the propeller end, and the propeller revolves in the opposite direction.

It is now permissible to state that the petrol consumption is very good, tests having demonstrated it to be  $\frac{1}{2}$  pint per horse-power per hour. At full throttle, therefore, the engine will consume approximately 63 gallons or 430 lbs. of petrol per hour. For a three hours' journey a *bagatelle* of 1,300 lbs. of petrol would have to be carried. Since, however, a

machine in which an engine of this power would be installed would carry probably at least 20 passengers, and cover about 400 miles in three hours, the figures for petrol are not nearly as terrifying as they may appear to be at first sight. As a matter of fact, the consumption is, of course, very good, and there is reason to believe that if the necessary number of passengers could be assured, a machine fitted with this engine would be a very good commercial proposition. We hope that before long it may be found possible to instal a "Cub" in a commercial machine. At present the engine is being put into a military machine of extraordinary promise, and it will be interesting to see her behaviour in the air. No reference is, however, permissible at present.

In connection with the problem of starting an engine of this power, it is of interest to mention that the "Cub" is provided with a distributor for a gas starter. As the choice of starters of this type is not a very wide one, it may fairly safely be guessed that this will be a "Bristol." Already this starter has been used successfully on engines of smaller power, and has demonstrated that it is thoroughly sound in principle.

As soon as it becomes permissible to do so we hope to publish a more detailed description of the Napier "Cub."

### NOTICES TO AIRMEN

#### Austria : Conditions Governing Flight

1. In consequence of the admission of Austria into the League of Nations the provisions of the Treaty of St. Germain-Laye relating to Allied aircraft flying over Austrian territory are no longer in force.

2. Foreign aircraft flying over or landing on Austrian territory must be provided with a permit issued by the Austrian Ministry of Roads and Communications.

(No. 24 of 1922.)

#### France : Antibes, Le Bourget and Beauvais

PREVIOUS Notices to Airmen relating to France have been amplified and amended in regard to, 1, *Antibes*—Customs Seaplane Station; 2, *Le Bourget*; and 3, *Beauvais*.

(No. 26 of 1922.)

#### France : Landing Grounds, etc.

CAUTIONS and care notified relating to France in regard to:—1. *Berck-sur-Mer*; 2. *Beauvais*; 3. *St. Quentin*; 4. *Carcassonne*. (No. 28 of 1922.)

#### Institution of Aeronautical Engineers

ON March 22, a party of twenty members with their friends visited the works of the De Havilland Aircraft Co., Ltd., at Stag Lane Aerodrome, Edgware. By the courtesy of the Company, Mr. C. C. Walker showed the party all the details of the numerous machines which were in course of construction. They were especially interested in the new monoplane which is putting up such a good performance in weight carried per horse-power.

In the evening, a Paper was read before the Institute at the Engineers' Club, Coventry Street, by Mr. W. O. Manning, M.I.Ae.E. (Hons). The title of the Paper was "Seaplane Design," and many members took advantage of hearing the Paper, the following taking part in the Discussion: Major Hume, Captain Nicolson, Capt. Sayers, Major Wright and Mr. Evans.

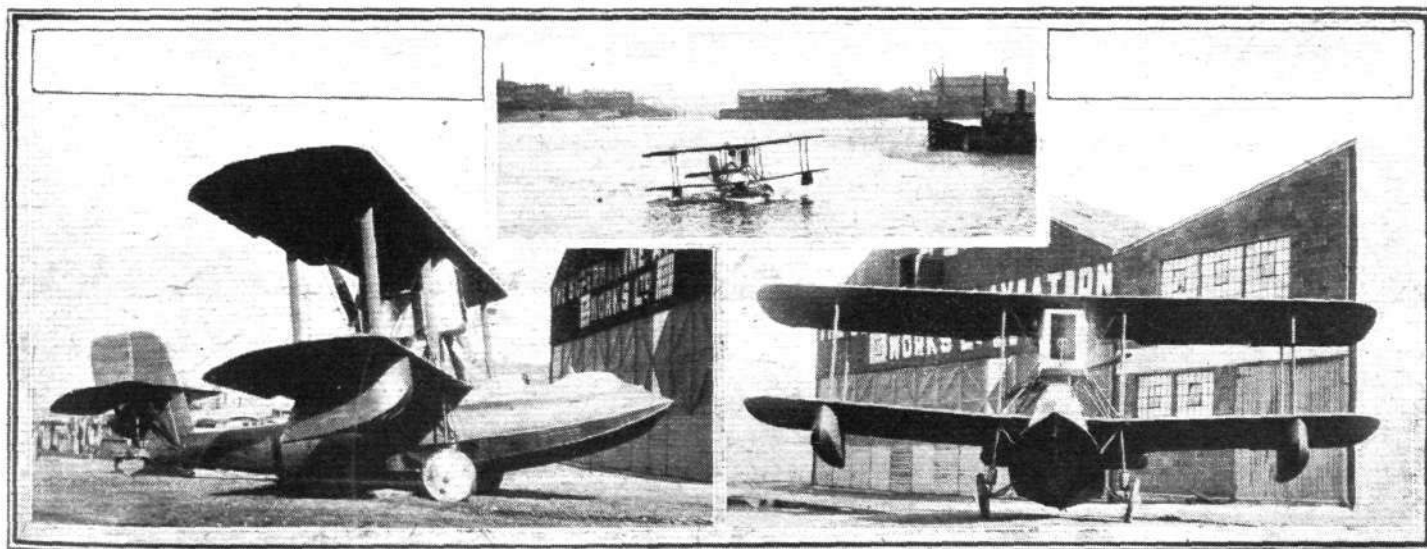
The next Paper, "Aircraft Design," will be read by Mr. H. P. Folland at the Royal Society of Arts, at 8 p.m., on March 31.

#### Portuguese and Atlantic Flying

FROM Lisbon it is reported that two Portuguese aviators contemplate an aeroplane trip across the Atlantic, from Portugal to Brazil. But as the time for starting was down for March 22-23, we are left wondering.

#### Our Airships' Doom

CABLE advices from New York, under date March 25, record the appearance in the chief newspapers of the offer by the British Government of the four airships R.33, 36, 37 and 80, with or without aerodromes, hangars and other equipments. Getting the aircraft across the "pond" is all right, but the shipment of the aerodromes arouses our curiosity.



A SUPERMARINE SINGLE-SEATER FIGHTING SCOUT AMPHIBIAN : Three illustrations of the "Sea King, Mark I," fitted with 300 h.p. Hispano-Suiza engine. This machine is capable of all the usual tricks of a land aeroplane, being capable of being looped, rolled, spun, etc.

## LONDON TERMINAL AERODROME

Monday, March 27, 1922.

STORMY weather over south-east England and the Channel interfered with the smooth running of the London-Paris Air Service at the beginning of the week. On Monday, the only machine to get through from Paris to Croydon was a D.H. 18 on the Instone service. Mr. Robins, who was piloting this machine, said that it snowed continuously all the way from Lympne to Paddock Wood, and that it was impossible to recognise any of the familiar landmarks. It was only by flying low and "hugging" the railway line that he was able to keep to his course. The inward Handley Page landed at Hawkinge, and the two French machines got down before they reached the Channel. All the machines from Croydon to Paris got through.

On Tuesday, the gale having increased, the service was entirely suspended, the only machine to fly at all being one of the Messageries Spads, which had landed in Northern France the day before, and which managed to fly on to Croydon. The normal air services were resumed on Wednesday, although some of the cross-Channel boats did not venture to leave port.

Saturday reproduced some of the activity of last summer, the aerodrome being alive with cars bringing both passengers and sightseers.

The Instone Air Line now bring their passengers to the aerodrome in a super-motor-char-a-banc. This is equipped as comfortably as a limousine car, but will, of course, seat a greater number of passengers. This car is also used to bring parties of interested people to the aerodrome on a sightseeing tour. The Instone Air Line are of the opinion that the air-station should be one of the popular sights of London, and one which all visitors should come to see just as they visit other places of popular interest. This idea has also occurred to the Lepaerial Travel Bureau, who are commencing a similar scheme of conducted sightseeing parties from London to the air-station. Arrangements are being made, also, to provide short flights for those who wish.

### The Value of Air Speed in Business

THE negotiations for the manufacture of Napier "Lion" engines in France are now nearing completion, and Napier's managing director, Mr. Vane, is at present in Paris in connection with this matter. On Saturday morning he discovered that certain papers which were required at a meeting in Paris that afternoon were still in London. Being familiar with the possibilities of air transport, however, that did not worry him overmuch. Telephoning to Napier's West-End offices, he asked Mr. F. H. Jones to catch the 12.15 "air-express" and bring the papers over to Paris. Mr. Jones, who did not leave New Burlington Street until 11.30, was in Paris with the required papers shortly after 3 p.m.

Rumour has it that Mr. Michael Collins, the President of the Irish Free State, has been in communication with the British air transport companies with the idea of arranging for an air service to Dublin. It is understood that the Irish Free State are prepared to offer a subsidy, but the terms are not yet known. This air-line would, of course, come under the heading of inland services, and the Air Ministry have already announced their willingness to subsidise a service of this character. Although somewhat off the direct route,

it is probable that Manchester would be made a stopping-place, should this scheme materialise.

Mr. Shaw tested the new D.H. 18 for Handley Page Transport on Saturday. The machine is very fast and climbs well. Later in the day Mr. Olley made the necessary six landings, piloting this machine, in order to have it put on his licence.

Mr. Bradley, who was with Aircraft, Transport and Travel and has now joined the Instone Air Line, piloted the Instone D.H. 4A to Paris on Sunday.

Mr. MacIntosh made a double trip on the Handley Page company's "Bristol," leaving Paris in the morning and returning on the same machine on the 12.30 service.

### The New Daimler Airway

A NUMBER of the Daimler Airway pilots and mechanics put in an appearance on the aerodrome today. Mr. Hinchliffe, who is to be chief pilot, and also aerodrome manager at Paris, was here with Mr. Duke in attendance. This company are due to commence operations next Monday, but there will have to be a tremendous last minute "hustle" if everything is to be ready.

Grands Express have just completed an agreement with the municipal rulers of Lausanne, Switzerland, which gives them a monopoly of air transport to and from that city. They are still running their week-end service from Paris to Lausanne, and there is a possibility that there will be a through one-day connection to London this year.

The Messageries Aériennes are now using their Goliaths to a greater extent on the London-Paris service, although we are still awaiting the advent of one of the Renault-engined Goliaths. On Saturday, their inward Goliath from Paris was compelled to land at Lympne, owing to weather. The passengers proceeded to London by train, and the machine flew up to Croydon the next morning.

### The Bulk Storage Fuel Schemes

THE big 7,000 gallon petrol tank that the Anglo-American Oil Company are putting down has now been lowered into its correct hole in the ground, and the pipes are being laid out to the hangars. Digging operations are proceeding for the tank that the British Petroleum Company are installing.

During the week, lighting experts were examining the red Strontium flare on the top of the permanent hangars with a view to improving it, and providing it with a permanent housing. I understand it is as effective as was expected, and that the Air Ministry officials are quite satisfied with it.

Captain Muir, of the Surrey Flying Services, was taking joy-riders for flights during the week-end. He tells me that the firm have a large number of bookings to attend fêtes and fairs during the summer. For May, in fact, they are quite booked up.

The service to Constantinople is to be run this summer. It will be a continuation of the present service from Paris to Warsaw, branching off at Prague. The route will be by way of Vienna, Budapest, Belgrade and Bucharest. It will be opened in stages. The last stage, that from Bucharest to Constantinople, will be opened on July 14. The through fare from London to Constantinople is to be £37 16s., and, when the Instone night service is running, it will be possible to reach Constantinople 40 hours after leaving London.

## THE LONDON-CONTINENTAL SERVICES

FLIGHTS BETWEEN MARCH 5 AND MARCH 18, INCLUSIVE

Route†	No. of flights*	No. of passengers	No. of flights carrying		No. of journeys completed†	Average flying time	Fastest time made by	Type and (in brackets) Number of each type flying
			Mails	Goods				
Croydon-Paris ...	47	94	21	36	45	h. m. 2 58	Bristol G-EAWY (2h. 15m.)	B. (3), Br. (1), D.H. 4 (2), D.H. 18 (2), G. (7), H.P. (2), Sp. (5), V. (1).
Paris-Croydon ...	49	138	11	42	43	2 48	D.H. 18 G-EAWW (1h. 56m.)	B. (3), Br. (1), D.H. 4 (2), D.H. 18 (2), G. (7), H.P. (1), Sp. (7), V. (1).
Totals for 2 weeks ...	96	232	32	78	88			

Note: One flight (1 pass.) between Croydon-Amsterdam made on 13th.

\* Not including "private" flights.

† Including certain journeys when stops were made en route.

‡ Including certain diverted journeys.



## THE AIR ESTIMATES DEBATE

ON March 21, upon the Air Estimates being presented to Parliament, Captain F. E. Guest, Secretary of State for Air, said he first desired to give expression to the satisfaction which had been felt, not only by those in charge of the Department, both Ministers and senior officers, but by the whole Royal Air Force, with the announcement made last week by the Leader of the House in connection with the separate and autonomous existence of the Ministry. Two of the foundations upon which they would rest now and in the future were—(1) that the Air Force must be autonomous in matters of administration and education, and (2) that in the case of defence against air raids the Army and Navy must play a secondary rôle. There were two great countries in which this subject was causing a great deal of interest, almost, he might say, consternation, due entirely to the unsatisfactory state of affairs existing in them. In America, he understood that the highest opinion was, at least, divided, and that some of the most influential opinion was very much impressed by the separate organisation in England. In France, where the Government had given a great impetus to aviation, a Commission had reported to the Chamber Committee on Military Affairs that in their opinion aviation would never have its proper influence and take its proper place until it was given complete autonomy and independence. It was quite clear that what we had been doing was being very closely watched, and he would not be surprised if our example was very shortly followed.

Previous to the economies effected under the recommendations of the Geddes Committee, the Air Force consisted of 32½ fighting units. The reductions in service strength which had been effected under those recommendations were the equivalent of two squadrons, and the reductions in their training schools might also be considered to be the equivalent of two more service units. So that they were, in fact, the equivalent of four service units weaker than they were before the Government went into the question of economies. They had still at their disposal 31½ service units, and of these 19½ were abroad, allocated as follows: India, six; Iraq, eight; Egypt, three; Palestine, one; and the Mediterranean, doing naval co-operation work, 1½. There were twelve at home, of which one was doing miscellaneous work—that was the communication squadron at Kenley; one was practically permanently allocated to Army co-operation; three were in reserve; and three would be, under the scheme which he would outline, their first modest contribution for home defence. The work done by the Air Force in different parts of the Empire, such as the North-West Frontier and Somaliland, illustrated the fact that Air Force action was less temporary than Army action, and proved two things—one, that under certain conditions, such as the patrolling and policing of semi-civilised portions of the Empire, the Air Force was quicker in action, cost far less, and, in its power to take life, more humane; and (2) that the effects were certainly not less lasting than those which were obtained by military expeditions.

Emphasising that they had already had evidence of the remarkable effect of aeroplanes in quickly suppressing outbreaks, Captain Guest gave several well-known instances, one being that against Sheik Mahmud, which was settled in a week with eight aeroplanes, as against the use, three years previously, of two brigades operating for two and a-half months in an exactly similar outbreak.

There was another point which the House would appreciate, and it was that in these countries the only way in which military forces could keep tribes in subjection was by placing garrisons in the semi-civilised areas. That was just asking for trouble. It offered the one opportunity that the natives were looking for, and that was something to come and sit round and strike at in the hope of eventually getting some rifles or some loot. They had, he regretted to say, had several detachments cut off in that country, but they proposed in the future, when the transfer took place, to adopt the more modern method of patrolling the country from a distance and of keeping their base well back among friendly tribes, and far out of reach of any marauding bands. In Iraq also an opportunity was afforded of carrying out one of their operational performances which might carry in its train the beginning of civil aviation there, and that was the development of the Trans-Jordan route. During the year they had established that line by air as a communication between Cairo and Baghdad. Both from the operational and the training point of view, this was a great advance. By this means quantities of official and public mails were carried from Cairo to Baghdad. It was used for reinforcements, and it

would very shortly be used for the evacuation of troops from Baghdad to Cairo. It enabled them to send to the eight squadrons of Baghdad all their spares, new machines, and impedimenta by this route in two or three days, instead of packing them all in crates and sending them round by the Persian Gulf and taking twenty-four days to do it. The whole of this route was covered in two flights. The total distance was about 900 miles, and the record flying was seven and a-half hours. There was a story of a forced landing in connection with this route which showed that they were rapidly becoming the handy men which their sister Service had claimed to be for so long. Some time ago an aeroplane fell from the formation owing to some kind of casual trouble. It came to the ground somewhere in the desert 500 miles from anywhere. The personnel were picked up by another aeroplane, and the disabled craft was left in the desert. In a few hours by means of transport the necessary spare parts were brought to it by another machine. It was repaired in the middle of the desert, and within three days from the time of the accident the aeroplane had flown away to its original destination.

After referring to what was being done in training the Air Force at Cranwell College, Lincolnshire, and at Halton, Captain Guest said that some new schools had been opened this year for intensive flying training for older officers. The greatest things were hoped from the Staff College at Andover, which was quite a new departure, and was the first of its kind in the world. We were the only nation who would have the advantage of a highly-trained Air Staff, and the Air Force could no more be run efficiently without a trained staff than the Army or the Navy. The problems were just as complicated, just as far-reaching, and quite different. A school of armaments and gunnery was being started at Eastchurch, and for the purposes of night flying an Anti-Aircraft Co-operation School at Biggin Hill had been opened. The method of technical training adopted in the Air Force was on quite new lines. Instead of spending large sums of money in building technical colleges, they were making use of the great civilian universities and colleges.

Reviewing developments in the realm of research during the last twelve months, Captain Guest said their activities had been largely directed to securing greater safety and comfort in travelling by aeroplane. A most important number of instruments for safer navigation of aircraft had been invented and brought into use. Great advance had been made in fire precautions. They had also developed air-cooled engines, which were a great advantage from the point of view of safety. Advance had been made in the direction of silencing engines, and study was now being directed to silencing the propeller. The new types of machines brought out this year were not many, but one was very important, and it was very hard to determine what place exactly the amphibian would play in aerial performances in the future. He was trying to arrange for scientific research to be carried on continuously, chiefly by the scientific bodies outside the Air Ministry, with financial assistance from the Government.

In regard to new responsibilities undertaken by the Air Ministry, he said that acceptance of the command of the forces in Iraq was the first practical experiment in the economical substitution of one arm for another. He could not guarantee success. They might get their set-backs just as other arms of the Crown had, but they thought they could satisfy those who resided in that land that those set-backs would be only temporary, and that they need have no fear that because of this substitution their lives would be in more danger. Referring to the decision of the Cabinet to hand over to the Air Ministry the responsibility for air defence against air attack, Captain Guest said it struck him at once that at night time it would be quite impossible to form a line of demarcation between the land and the sea, and that unless the command were unified, we should have both the Army and the Navy each feeling it incumbent upon them to have its own system of defence against air raids. The only defence against air raids was by fighting in the air. It was no good imagining that surrounding our cities and coasts with batteries of anti-aircraft guns would really serve the purpose required. That was the last line of defence. The first line of defence was carrying the fighting into the enemy's area. That, coupled with air fighting in its highest form, was the only method by which an invasion of that character could be overcome and repelled.

In regard to home defence the Air Ministry were availing themselves of the experience of other countries. Provision

for home defence was made on a much larger scale by other countries, but, of course, their conditions in each case varied considerably. The Americans were no guide to us, but they had roughly twenty-seven squadrons within their own areas, although their Service was in its infancy. Italy had made a start, and had something like 400 machines to-day. In Japan there was considerable development, but the biggest development had been in France, which, having had experience of invasion by aircraft, was determined it should not occur again if it could be at all defeated. The Air Force for home defence in France consisted of sixty to seventy squadrons, apart from those available for Army and Navy co-operation, and there were reports of a very largely increased programme. The French squadron was made up of eight aeroplanes for fighting and twelve aeroplanes for bombing. The strength of our squadron was twelve machines (in war, eighteen). In this connection, he thought the article in *The Times* by a distinguished late officer of the Flying Corps was of great interest. Another point of importance was that the Air Force would form a link between the forces that fought on sea and on land. The Army and Navy were dependent for assistance in the air for all future manoeuvres, but the Air Service could act perfectly well without either. If it were to break down the barriers which had for so long existed between the Army and Navy, by providing a common meeting ground for the two Forces, it would be a great advantage to those branches of the Service and to the nation as a whole.

There were three recommendations of the Geddes Committee in regard to the Air Force with which the Government disagreed. The first was the total abolition of eight and a-half squadrons at home which were used for Army and Navy co-operation. This, it was said, would effect economies amounting to £2,500,000, though the figures by which the calculation was arrived at were confused. But what was entirely ignored was the fundamental argument that those squadrons were the only reserves from which the officers and men required for the squadrons overseas were to be obtained. The second recommendation of the Geddes Committee, from which the Government differed, was the abolition of the boys' training school. He feared that without the school the skilled men required by the Service could not be obtained. For the technical knowledge needed in the Service fifty-four trades had to be learned. As to Halton expenditure, they were within 20 per cent. of completion of all the buildings, and then the organisation they had wanted ever since the end of the War would be completed. Moreover, they had economised towards that by prolonging the service by two years. The Geddes Committee were wrong in suggesting that the re-conditioning of machines was simply intended to make the machines pretty. On the contrary, it increased the life of a machine from three years to four. He recognised that this had a disadvantage. If there were no new orders for machines, the civil industry would collapse.

Captain Guest having dealt generally with the figures in the Votes themselves, said the exact economy effected in the Estimates under the recommendations of the Geddes Committee was £6,500,000. Half a million of that was a reduction in war liabilities, and therefore they could not claim more than £6,000,000, or 37 per cent. of their original estimated expenditure. He wished to take that opportunity of informing those outside that the Air Ministry would in future grant no more commissions than they could guarantee careers for. They had also decided to make a further experiment with non-commissioned pilots by recommendation and selections from men under twenty-five and not above the rank of Sergeant, or below that of leading Aircraftsman.

Proceeding to outline a new scheme of internal organisation at the Air Ministry, he said that up to the present the Service side has been represented on the Air Council by one member only, the Chief of the Air Staff. Now he proposed to place the Council more on a footing with the Board of Admiralty and the Army Council, and to broaden the basis of responsibility. The Chief of the Air Staff would continue to be senior member of the Council, and would have control of the Operations, Intelligence, Training and Works Department, but he would be relieved of all duties connected with discipline, personnel, organisation, equipment, and transportation. The Director-General of Supply and Research and the Director-General of Personnel would share those duties. Dealing with the Civil Aviation Vote of £350,000, he said £200,000 of it was taken up with subsidies and £80,000 by meteorology. As it would take a considerable time to bring this Department into conformity with the reduced scale of the other Departments, he had invited Sir Frederick Sykes, whose appointment as Director-General would normally

terminate on April 1, to retain his post for a further period of one year. The contraction of civil aviation was in no way the fault of the Department over which Sir F. Sykes presided. It was the difficulties of the times in which they lived that were responsible. It might be that in time to come this side of their work would expand.

With regard to the position of the airships, he said that the Government had reluctantly come to the decision to hand over the entire fleet to the Disposals Board. On the subject of the cross-Channel services, he said that he was very much in favour of maintaining them, as they acted as a demonstration and an advertisement of what was now possible. He also regarded them as the initial stages in the future development of schemes of Imperial communication. We had, as an Empire, a much more vital interest in civil aviation than any other country. It was the definite policy of the Ministry steadily to develop the further links in the Imperial chain, and as soon as the various stages were safely opened to hand them over to civil aviation to be developed on commercial lines.

It was his duty to look beyond the horizon and to the probable future, and when one considered the rapid advances during the last ten years it was impossible not to indulge in some flight of imagination. Two hundred miles an hour was now a normal rate, and 560 miles' continuous flight an ordinary performance. With the exception of fog, weather was now a negligible consideration. From the point of view of national defence, he held that the force was now powerful enough to defend our shores against invasion from the air. It was his belief that in the next few years powerful aircraft would progressively expand in areas in which enemy ships could not move with impunity. This would bring about further economies in ships of war. The possibilities of the bomb dropped from above were so far only partially explored; but it had been shown that they were terrible. One bomb dropped from the air could destroy the most powerful battleship in a few minutes. In ten years' time he believed that a combat between the forces of the air and the forces of the sea would have become a grotesque and pathetically one-sided affair. In the field of transportation he could see aeroplanes conveying small portions of artillery to the lines of operation, so dispensing with vulnerable lines of communication. When the finances of the nation justified the capital expenditure, such expenditure would give a substantial return in the decrease of blood and treasure in the minor wars in which an Empire like ours was constantly engaged.

The Air Force was a wondrous creation. It was a service of young men, enthusiastic men, led and inspired by an incomparable chief. It was this service which would eventually have to meet the first clash of war should it ever come again. The battle in the air would be joined before the Army reservist had reached the station or the battleship had got up steam. That was the duty of the Air Force, and it was with this forecast that he confidently submitted the Estimates to the House.

Major-General Seely congratulated the Air Minister on his lucid statement, and also on the result of the careful enquiry made by the Committee of Imperial Defence, which had definitely disposed of attacks made upon the establishment of a separate Air Ministry and a separate Air Force. He rejoiced also at the decision that the education of the airman was to be altogether distinct from that of men of other forces. He pleaded with the Secretary of State to try to prevent the standardisation of manuals, and not to let his manuals increase too fast. Let him keep the education of the Royal Air Force what it really should be—a thing constantly seeking new methods and new ideas. He urged that the Secretary of State should have a seat in the Cabinet, with the First Lord of the Admiralty and the War Minister. This should be the rule—all three should be in the Cabinet or none should be in the Cabinet. He regarded it as a very serious thing to give up all practical research into airships while other nations were carrying on researches, and he could not believe that it was wise completely to abandon experiments in this matter. So far as economy was concerned, he thought they had probably gone quite as far as it was safe to go.

He had been furnished with some remarkable figures as to what the French were doing. His figures differed very slightly from those of the Secretary of State, and only in one particular from those given by General Groves in *The Times*. At the end of last year the French had 126 squadrons of eight or nine machines each, and of these only four-nineteenths were abroad. If their present programme was carried out, the French Government would have 220 squadrons, of which from 165 to 170 would be at home, in order



to maintain the integrity of their country. The Air Minister told them that for this specific purpose he had three units. No one had ever seen what an air attack would be like. We were going to have air attacks in 1919, and as he was partly responsible for preparing them, he knew that the facts and figures given by General Groves were perfectly accurate. Nobody ever attempted to bomb a place with more than fifty aeroplanes during the War, but it would be quite easy, and no doubt would be done if ever they went to war, to bombard with 300 aeroplanes, which would carry, not the little bombs that were carried by the thirty-six aeroplanes that raided London, but bombs at least ten times that weight and at least four or five times the effective power per weight of projectile dropped. It was hopeless to attempt to protect yourself against raids with 300 aeroplanes. It took 32,000 men to protect London against the raids of thirty-six machines, and then they only made it more difficult for them. He urged that in order to meet the new kind of danger in future we must have the most highly skilled staff and men, and we must have the power of expansion. We had a very much larger proportion of skilled pilots than any other country, and he believed that in technical training we were as great as, if not greater than, any other country. But in power of expansion we were ridiculously short, as compared with other nations. We should, therefore, so encourage civil aviation as to have a reserve by which in an emergency our machines could be greatly increased.

Lieut.-Colonel Moore-Brabazon said that for over a hundred years the Navy had been the spoiled darling of the nation. But it was for one reason only, and that was that they could defend us. But a vast change had taken place. If the Channel were dried up, could the Navy defend us? Something tantamount to that had occurred when the air became an avenue of attack. Consequently the Navy could no longer be responsible for the defence of the country. He had heard it said that the Navy alone could protect the commerce of the country on the high seas. During the War the Navy was unable to do that without the assistance of air power. In these circumstances, was it not logical to put a Service which could not do a thing under a Service which could? Surely, people realised now that the Navy today was obsolescent. The poor Air Force was attacked from every side, but that force did know that they were a power for economy. We had a certain amount of money to spend on defence, and we must use it to the best advantage. From the point of view of defence, the Air Force must take first place. And yet, while £130,000,000 was allotted to the Army and Navy, only £10,000,000 was allotted to our first line of defence.

Sir W. Joynson-Hicks said the next war would be a war in which women and children would be bound to suffer as much as men, and would probably break out without the possibility of our knowing twenty-four hours beforehand. We were as vulnerable from the air as France was, and it was ridiculous to say we were prepared for the future with half a dozen Service squadrons at our disposal. He asked whether any arrangement had been made with regard to the new kingdom of Egypt for our hold upon Egypt as an air centre. He was one of those who believed that the air was destined in the future very largely to supersede both the Navy and the Army. Knowing all that the Air Service did during the War, knowing what those of them who believed in the Air had prophesied, he wanted the House to approach the question from the point of view that the Air in the next few years was going to be the paramount Service, and was not going to be looked upon merely as an auxiliary. The question would be, how much money it was desirable to transfer from the Navy and the Army to the Service which would gradually take the place of these two great Services.

Field-Marshal Sir H. Wilson said soldiers and sailors were as fully alive to the coming powers of the air as anybody in the Air Force. It was because they wanted to have all the power possible from the air that they disliked an independent Air Force, and not because they disparaged the air. That it was absolutely essential to guarantee a supply of air machines, and even of personnel, as between the Navy and the Army was certain; but he challenged the contention that because they did that they must go another step, and have an Air Force independent of the Navy or the Army. So far as he knew, we were the only country that had decided to have an independent Air Force. What was happening now was that in order to become autonomous the Air Force was duplicating practically every service in the Army and the Navy, at a time when we were very hard up.

He did not quite understand the decision—that the Air should take over anti-air defence at home. Here we were

duplicating a complete little service; for it was quite certain that in any future theatre of operations there would have to be anti-aircraft. We were spending very little money on, and getting very little from, civil aviation. If a big war came, the Air Force would require an enormous expansion. He therefore pleaded strongly for a big sum of money to be devoted to civil aviation, on which we should have to depend for such expansion.

Lord H. Cecil said that no discipline and management of the Air Force was possible unless that Force was independent, and he hoped that the Government would not fritter away their wise decision to maintain a separate Air Force by, under the name of co-operation, conceding any control of discipline, promotion, or training either to the Navy or to the Army. As to home defence, there was no advantage in having only three squadrons. Either they must compete with Continental nations, or they must make no attempt whatever. The arguments used filled him with the conviction that the whole thing was impossible. An air struggle between two European Great Powers could only result in the total destruction of both.

Colonel Wedgwood said the debate was highly valuable. What we had to do now was to instil into the minds of the Admiralty and War Office some conception of the power and capacity of the new arm. Most people must now see that the Navy was not our first line of defence, but rather the Air Force.

A discussion then followed upon an amendment put forward by Lieut.-Col. W. Guinness to the following effect: "In the opinion of this House, to enable the best use to be made of the Air Service, all defence forces should be represented on and their activities co-ordinated by the Committee of Imperial Defence, which should meet regularly and frequently; and that a Minister, who is not departmentally responsible for any of the fighting Services should be appointed as permanent Vice-Chairman of the Committee, to take the Chair in the absence of the Prime Minister."

Mr. Churchill ultimately replied to the whole discussion by saying the question of first importance raised by the debate was, "Ought there to be a separate Air Service?" But, surely, for the time being, at any rate, there was in existence a separate Air Service established by Act of Parliament. It was born in the convulsions of the Great War. The only question now was whether we should go back on our experiences derived from the War and repeal the Act setting up the Air Ministry. The developments which were in progress in the War were, owing to our having run short of Germans, never reached. Had it been continued another year, or a year and a-half, people would have seen an entirely new consideration brought into the whole struggle. Military science as it was at the close of the struggle must be our starting point for the future. A separate Air Force existed by Act of Parliament, and extraordinarily strong arguments would have to be adduced by those who wished to make a change. We must be sure that in the great developments which were taking place we had leadership in all forms of aerial war from a defensive point of view. The greatest form of defence would undoubtedly be offence. Did the House think the Air Service would get its chance if it were separated into two parts—one handed over to the Navy and the other to the Army. The whole prejudices of the higher officers of the Army and Navy must lead them to depreciate the possibilities of this new and subversive element. As to the relations of the Air Force and the Navy, he felt that it was the business of the Air Force to cater for the Navy, just as it catered for the Colonial Office. They knew how easily the relations of the Army with the Air Force in France were adjusted in the course of the War. But the Navy was more specialised in some ways, and it would be a great mistake for the Air Ministry not to put the Admiralty at their ease in this matter. A Committee had been set up to examine the question, and he believed that they would be able to come to an agreement.

The point was not the division of the responsibility as if it were booty to be shared, but the harmonious association of the three Services in the discharge of a common duty. There was no final solution of a harmonious kind of these difficulties except in a Ministry of Defence. But they could not possibly achieve that at the present time. The practical steps which it was open to them to take were being taken. The creation of the brain of a common service was to be the subject of an enquiry by a sub-committee of the Committee of Imperial Defence. A system of training which would unite officers of middle rank in the three Services ought not to be delayed, and the sub-committee was being set up with directions to formulate such a scheme. He thought that was all it was wise and practicable for them to do this year.

The amendment was then withdrawn.

# PERSONALS

## Married

Capt. CHARLES STEWART TOUZEAU LAVERS, D.F.C., elder son of Mr. and Mrs. C. H. Lavers, Clarence Road, St. Albans, was married on March 15, at The Abbey, St. Albans, to ELSIE, younger daughter of Mr. and Mrs. A. H. SMITH, "Norland," Woodstock Road, St. Albans.

## To be Married

The engagement is announced between M. PHILIP E. HARRISSON, late the Buffs. and R.A.F., eldest son of Major A. H. P. Harrisson, late the King's Regiment, and Mrs.

Harrisson, of Greenhill Farm, Farnham, Surrey, and NESTA, only daughter of Mr. and Mrs. F. P. NEVE, of Johannesburg, South Africa.

A marriage has been arranged, and will take place at the Parish Church of Lochbroom on June 7, between Sqdn.-Ldr. H. A. HEWAT, R.A.F., M.S., younger son of the late R. G. Hewat and of Mrs. Hewat, 2, North Charlotte Street, Edinburgh, and ISOBEL MARGARET, elder daughter of Lieut.-Col. J. W. FRASER, C.M.G., and Mrs. FRASER, of Leckmelm, Garve, Ross-shire.

## ROYAL AERONAUTICAL SOCIETY NOTICES



**Lectures.**—The remaining lectures of the present session are as follows: March 30, Capt. G. de Havilland on "The Design of a Commercial Aeroplane"; on April 6, at 5.30 p.m., M. Louis Breguet will read a paper on "Aerodynamical Efficiency and the Reduction of Air Transport Costs."

**Election of Members.**—The following Members were elected at a meeting of the Council held on March 21:—

**Associate Fellow.**—Squad.-Ldr. J. Sowrey, A.F.C.

**Students.**—G. F. Law, A. E. Woodward Nutt, A. D. Patwardham, E. J. D. Townesend, T. E. Waldeck.

**Member.**—Capt. S. H. Starey.

**Foreign Members.**—Lieut.-Cmdr. R. Arisaka, I.J.N., Capt. D. Tiselius, R.S.N.

**Associate Fellowship Examination.**—The Council have decided, as a result of representation which has been made to them, to hold the examination for Associate Fellowship in September next, instead of in April this year, as it has been found that this would be more convenient for the majority of Students who desire to sit for the examination, owing to their studies having been delayed by the War. Intending applicants should forward their names to the Secretary not later than July 31.

W. LOCKWOOD MARSH,  
Secretary

## CELLON DEVELOPMENTS

### "Cerric" Productions

"DOPED with Cellon" has become what one might call a standard aeronautical term, meaning, in simple language, that the fabric, or whatever it is, has received a special treatment whereby it is rendered fit to carry out its functions. Our readers, however, are thoroughly conversant with the nature of doping fabrics, etc., and with the high qualities of Cellon, but we venture to state that few realise the enormous amount of research and laboratory work entailed in the production of an efficient dope, such as Cellon. The manufacturers of the latter dope, "Cellon (Richmond), Ltd.," have during the past dozen years or so carried out a considerable amount of research in the matter of the various cellulose constituents suitable for use as aeroplane dopes.

As a result, not only were they able to produce a full range of highly efficient dopes suitable for all conditions, but the extensive knowledge obtained of the properties of the cellulose and other components involved has opened up a new and remarkably wide field for their application other than for aeroplanes dopes. Although not connected directly with aviation, a brief reference to this new "side line" of Cellon's will, we think, interest many of our readers. It consists, metaphorically speaking, of various processes for "doping" innumerable articles of everyday use and so preserving their surface, or giving them an artistic finish.

The "dope" employed is not the same as the aeroplane dope, but varies according to the particular use to which it is being put. In each case, however, cellulose forms the base one way or another, and a thin hard film—polished or matt—covers the surface of the article treated. The variety of articles that can be treated—and the variety in character of the treatment—with "Cerric" productions, as they are called, is really astonishing, as may be gathered from the following examples:—

"Cerric" Enamels: These are applicable wherever a matt or highly-finished glossy surface is required, as for fancy boxes, tins, baskets and other fancy articles, table tops, trays, ornaments, etc. The enamels are made in all colours, and are easily and quickly applied either by spray, brush or dipping; they dry—very rapidly—with an "egg-shell" finish, a glossy surface being obtained by buffing or by a final coat of "Cerric" varnish. "Cerric" enamels are not affected by hot articles standing on them, nor by spirits, water, petrol or oil. We have seen several examples of ordinary, unglazed clay pottery, treated with "Cerric" in a variety of colours, glazed and matt, and it must be admitted

that the finish and artistic effect were equal to any high-class fire-glazed pottery; clay pottery so treated is water-proof.

"Cerric" White Enamel, or "Porcelac," gives a porcelain-like surface to the articles to which it is applied, and being antiseptic and washable is specially suitable for surgical fittings, sanitary, and hospital furniture, or bath-room, etc., fittings. "Cerric Black Enamels give "Dead Matt," "Matt," "Semi-Matt," or "Glossy" finishes, and do not require stoving, and do not chip or crack. These enamels are suitable for motor accessories, lamps, instruments, and woodwork.

"Cerric" Lacquers greatly facilitate all forms of lacquer work, they are colourless, and may be applied by spray, brush or dipping to any metal article without affecting its colour. Coloured lacquers in all standard shades of gold, or any special colour, are also produced.

French Polishing is an exceedingly tedious process, requiring also no small amount of skill for the best results. By the use of "Cerric" Wood Solutions exactly similar effects may be given to wood surfaces by spraying, instead of the usual lengthy operations obtaining in French Polishing, but with this advantage: they withstand the action of spirit, water, petrol, etc., and are not effected by the contact with hot articles. They are transparent, the wood being treated with "Cerric" wood filler, and then stained the desired shade, before the application of the solution.

Bronzing—for picture frames, mouldings, mounts, furniture, fancy goods, etc.—may also be done by means of the "Cerric" Bronzing Medium, which gives a beautiful finish that does not crack or chip and prevents tarnishing and rusting. A metallic powder of any desired shade is mixed with "Cerric" Medium and applied to the article by spray—or special Medium can be supplied for applying by brush or by rollers.

Other "Cerric" products consist of Leather Solutions in black and all colours (the leather does not lose its flexibility by the use of these solutions); Artificial Leather Solutions for leather cloth and leatherette paper, in all colours, waterproof and flexible; Wall Paper Solutions, Matt or Glossy, also waterproof; transparent colours for electric lamp bulbs, etc.; and "Cerric" Paper Varnishes, for show cards, posters, etc.

Thus, our readers will see that the uses to which these various "Cerric" products—originating from the "Cellon" Aeroplane Dopes—can be put are many, and their advantages over existing methods very considerable in several cases.



# THE ROYAL AIR FORCE

London Gazette, March 21, 1922  
 General Duties Branch

Flying Offr. E. D. H. Davies is granted a permanent commn., retaining, his present substantive rank and seny.; Sept. 16, 1919. *Gazette*, Sept. 16, 1919, appointing him to a short service commn. is cancelled. Flight Cdt. G. C. Shepherd, having successfully passed out of the R.A.F. (Cadet) College, is granted a permanent commn. as a Pilot Offr.; Feb. 27. C. V. A. Bucknall, late Lt., the Inniskilling Drngs., is granted a short service commn. as a Flying Offr., retaining his original seny. in the R.A.F.; March 7. W. A. Chase is granted a short service commn. as a Flying Offr. with effect from and with seny. of March 7. Flying Offr. L. H. I. Bell is placed on Retired List on account of ill-health; March 22. Flying Offr. E. S. Robins resigns his permanent commn. and is permitted to retain rank of Lt.; March 22. Flight Lt. B. C. Meates is transferred to Reserve, Class A; March 22.

## Medical Service

J. C. T. Fiddes, M.B., is granted a short service commn. as a Flight Lt., with effect from and with seny. of March 6. Squadron Ldr. R. I. Roe, O.B.E., M.B., relinquishes his short service commn. on account of ill-health, and is permitted to retain rank of Maj.; March 22.

## Stores Branch

The follg. are granted short service commns. as Flying Offrs., with effect from, and with seny. of, Feb. 25:—S. A. Martindale, C. W. Rugg, C. N. Scott.

The follg. are granted short service commns. for Accountant duties as Flying Offrs. on probation; Feb. 20:—J. Baines, J. J. Caiger, F. C. Chalmers, W. E. Ennis, W. E. Fisher, M.C., A. W. Gray, R. W. Leamon, W. E. V. Richards, R. G. D. Thomas, A. E. Vautier, M.C.

NOTE.—The seny. of offrs. granted commns. in the Stores Branch for Accountant duties is provisional only. The final seny. list of all such offrs. will be promulgated when establishment is completed.

## Memoranda

Capt. R. H. Moore relinquishes his tempy. commn. on ceasing to be employed, and is permitted to retain his rank; Feb. 15.

The permission granted to Lt. G. G. Moore to retain his rank is withdrawn on his joining the T.A.

London Gazette, March 24, 1922

## General Purposes Branch

The follg. are placed on half pay, Scale B.—Flight Lieut. H. G. Bowen; March 18. Flying Offr. B. Ankers, D.C.M.; March 13.

## Stores Branch

The date of transfer to the Stores Branch of Flight Lieut. D. W. Wilson is Jan. 13, 1921, and not June 17, 1920, as *Gazette*, May 24, 1921. Flight Lieut. H. V. Jerrard is restored to full pay from half pay; March 20.

## Memorandum

Sec. Lieut. R. C. Taylor relinquishes his temp. commn. on ceasing to be empld., and is permitted to retain his rank; March 21, 1919.

## ROYAL AIR FORCE INTELLIGENCE

**Appointments.**—The following appointments in the Royal Air Force are notified:—

*Group Captain* U. J. D. Bourke, C.M.G., from Half Pay List to Command Inland Area Aircraft Depot (Inland Area). 10.4.22.

*Wing Commander* J. C. Halahan, C.B.E., A.F.C., to Command R.A.F. School (India). 9.2.22.

*Squadron Leaders.*—A. C. Winter, O.B.E., from No. 24 Squadron (Inland Area) to No. 4 Flying Training School (Middle East Area). 10.3.22. M. G. B. Copeman from Armament and Gunnery School (Cadre) (Inland Area) to Headquarters (Middle East Area) (Supernumerary). To command No. 2 Armoured Car Co. (on formation). 10.3.22. B. P. Henry de Roeper, A.F.C., from School of Photography (Inland Area) to No. 1 Flying Training School (Inland Area). 20.3.22. H. E. Bell, M.B., from Headquarters No. 11 (Irish) Wing to Headquarters, R.A.F., Ireland. 17.2.22. J. T. Whittaker, M.C., from R.A.F. Depot (Inland Area) to Command No. 28 Squadron (India). 7.3.22. H. E. M. Watkins, A.F.C., from Seaplane Training School (Coastal Area) to Headquarters, Iraq Group (Supernumerary). To command R.A.F. Rest Camp (on formation). 7.3.22. F. C. Williams, O.B.E., from No. 4 Stores Depot to Headquarters, Iraq Group (Supernumerary). 7.3.22. W. Millett, from Headquarters, Inland Area, to Headquarters, Iraq Group (Supernumerary). 7.3.22. C. S. Wynne-Eyton, D.S.O., from Headquarters, No. 11 (Irish) Wing, to Headquarters, R.A.F., Ireland. 17.2.22.

*Flight Lieutenants.*—P. C. Livingstone, D.P.H., from No. 28 Squadron (India) to No. 20 Squadron (India). 16.10.21. H. Carmichael Irwin, A.F.C., from R.A.F. Airship Base (Coastal Area) to Headquarters (Coastal Area) (Supernumerary). 24.2.22; and to R.A.F. Base, Leuchars, 15.3.22. W. A. Kingston, from R.A.F. Airship Base (Coastal Area) to Headquarters (Coastal Area). (Supernumerary.) Pending closing down of R.A.F. Airship Base. 24.2.22. S. Nixon, O.B.E., from R.A.F. Airship Base (Coastal Area) to Headquarters (Coastal Area). (Supernumerary.) To remain attached to Pulham Airship Station. 24.2.22. J. E. M. Atherley, from R.A.F. Depot (Inland Area) to Armament and Gunnery School (Cadre) (Inland Area). 24.3.22. H. V. Drew, A.F.C., from R.A.F. Airship Base (Coastal Area) to No. 10 Group Headquarters (Coastal Area). 15.3.22. L. Whitworth,

A.F.C., from R.A.F. Airship Base (Coastal Area) to R.A.F. Depot (Inland Area). 15.3.22. C. H. N. Nunn, from R.A.F. Depot (Inland Area) to Armament and Gunnery School (Inland Area). 1.4.22. J. F. Roche, from Instrument Design Establishment (Inland Area) to Experimental Section, Royal Aircraft Establishment (Inland Area). 1.4.22. J. C. Thomas Fiddes, M.B., to Research Laboratory and Medical Officers' School of Instruction (Inland Area). On appointment to Short Service Commission. 6.3.22. R. M. King, from R.A.F. Depot (Inland Area) to No. 207 Squadron (Inland Area). 16.3.22. C. B. Cooke, from Inland Area Aircraft Depot (Inland Area) to Aircraft Depot (India). 7.3.22. A. P. V. Daly, from School of Technical Training (Men) (Inland Area) to No. 60 Squadron (India). 7.3.22. A. T. Williams, from Boys' Wing (Cranwell) to Headquarters, Iraq Group (Supernumerary). 7.3.22. J. Leacroft, M.C., from R.A.F. Cadet College (Flying Wing) (Cranwell) to Headquarters, Iraq Group (Supernumerary). 7.3.22. E. L. Ardley, from No. 27 Squadron (India) to No. 1 Wing Headquarters (India). 20.2.22. J. A. Slater, M.C., D.F.C., from No. 5 Flying Training School (Inland Area) to No. 4 Flying Training School (Middle East Area). 8.3.22. F. M. Rope, from Aeroplane Experimental Establishment (Coastal Area) to Headquarters, Iraq Group. 7.3.22. W. R. Cox, M.C., A.F.C., from R.A.F. Cadet College (Flying Wing) (Cranwell) to Headquarters, Iraq Group. 7.3.22. C. F. Horsley, M.C., from No. 24 Squadron (Inland Area) to Headquarters, Iraq Group. 7.3.22. H. B. Russell, A.F.C., from No. 39 Squadron (Inland Area) to Headquarters, Iraq Group. 7.3.22. H. E. P. Wigglesworth, D.S.C., from R.A.F. Depot (Inland Area) to Inland Area Aircraft Depot (Inland Area). 20.3.22. H. J. Roach, A.F.C., from R.A.F. Depot (Inland Area) to No. 1 School of Technical Training (Boys) (Halton). 20.3.22. H. G. Bowen from R.A.F. Depot (Inland Area) to Half-pay List. Pending embarkation overseas. 18.3.22. H. V. Jerrard, from Half-Pay List to R.A.F. Depot (Inland Area) (Supernumerary). 20.3.22. J. C. T. Fiddes, M.B., from Research Laboratory and Medical Officers' School of Instruction (Inland Area) to R.A.F. Depot (Inland Area). 20.3.22. N. S. Douglas from Egyptian Group Headquarters (Middle East Area) to No. 56 Squadron (Middle East Area). 19.2.22. L. Wanless-O'Gowan, from Staff of Military Attaché, Tokio, to R.A.F. Depot (Inland Area) (Supernumerary). 17.1.22.

## IN PARLIAMENT

### Air Attachés

MR. RAPER asked whether France has decided to withdraw her Air Attachés?

Captain Guest: I am not aware of any general withdrawal by France of her Air Attachés, but their number has been recently reduced from seven to four.

Mr. Raper: Is it not a fact that France has withdrawn her Air Attachés, and, if that is so, will he then agree to withdraw our Air Attachés?

Captain Guest: No. The facts do not bear out the suggestion of the hon. Member. The number reduced by the French Government is from seven to four, but one in London still remains.

## PUBLICATIONS RECEIVED

*Acoustics of Moving Sources with Application to Airscrews.* By Prof. G. H. Bevan, F.R.S. Aeronautical Research Committee Reports and Memoranda, No. 684. August, 1920. London: H.M. Stationery Office. Price 6d. net (post free 7d.).

*Experiments on Rigid Airship "R.29."* By J. R. Pannell and A. H. Bell. Aeronautical Research Committee Reports and Memoranda, No. 675. January, 1920. London: H.M. Stationery Office. Price 1s. 6d. net (post free 1s. 7½d.).

*Technical Note No. 84. New Data on the Laws of Fluid Resistance.* By C. Wieselsberger. National Advisory Committee for Aeronautics, Navy Building, Washington, D.C., U.S.A.

*Technical Note No. 86. Surface Area Coefficients for Airship Envelopes.* By W. S. Diehl. National Advisory Committee for Aeronautics, Navy Buildings, Washington, D.C., U.S.A.

### Halton Air Station

MR. RENDALL on March 20 asked the Secretary of State for Air whether all the land and premises owned by the Government at Halton, Dorset, are now occupied by the Air Ministry; if not, in whose hands the remainder is; for what purposes the Air Ministry is using the Halton property; and how many airmen, mechanics and cadets he intends shall be stationed at Halton when the buildings now in progress are completed?

Capt. Guest: The answer to the first and second questions is, about 60 per cent. of the original land and premises, the remainder being either sold or about to be sold by the Disposal and Liquidation Commission; to the third, as a training station for mechanics and also as a hospital serving a group of stations; to the fourth, about 3,000.

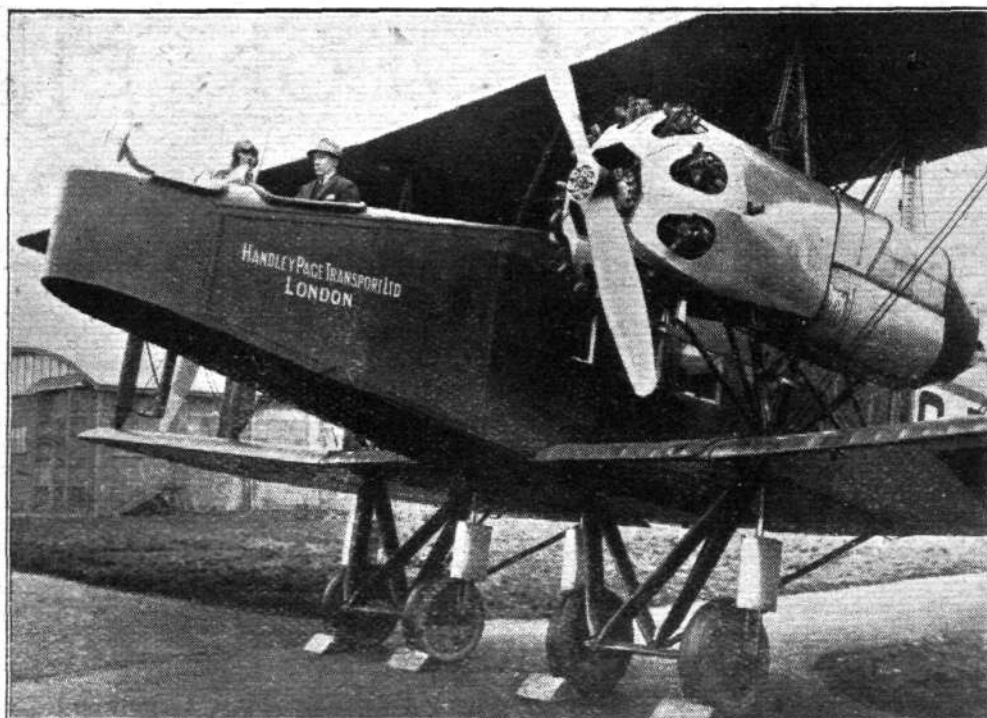
*Technical Note No. 89. The Choice of the Speed of an Airship.* By Max M. Munk. National Advisory Committee for Aeronautics, Navy Building, Washington, D.C., U.S.A.

*Report No. 113. Tests on Air Propellers in Yaw.* National Advisory Committee for Aeronautics, Navy Building, Washington, D.C., U.S.A.

*Report No. 123. Simplified Theory of the Magneto.* National Advisory Committee for Aeronautics, Navy Buildings, Washington, D.C., U.S.A.

*Report No. 139. Influence of Model Surface and Air Flow Texture on Resistance of Aerodynamic Bodies.* National Advisory Committee for Aeronautics, Navy Building, Washington, D.C., U.S.A.

*Report of the Commercial, Industrial and Economic Situation of Italy in December, 1921.* By J. H. Henderson, O.B.E. Department of Overseas Trade. London: H.M. Stationery Office. Price 1s. 9d. net.



### THE LONDON AERO-MODELS ASSOCIATION

COMPETITION No. 5. Mr. F. J. Camm's Cup. Full particulars will be published later.

COMPETITION No. 7. Mr. Felix Kelly's Cup. For best duration in a single flight by compressed-air driven model aeroplane. Conditions of competition as follows:—The holder of the Cup for each year to be the entrant of the machine giving the best performance under the following conditions:—

- (1) Models to be limited to those driven by compressed air.
- (2) Minimum weight complete, 1 lb.
- (3) Winning flight minimum duration, 1 minute.
- (4) Minimum loading, 8 ozs., equals 1 sq. ft. for all horizontal surfaces. In the case of a dihedral or other angle, the area of such surfaces will be measured separately.
- (5) Machines to rise off the ground under their own power.
- (6) Flights to take place over reasonably level ground.
- (7) Machines at termination of flight to be in proper flying condition, and shall make a further flight, rising off the ground, of at least 15 secs. to prove its proper flying condition is still unimpaired.
- (8) All air containers to be inflated by pumps operated by physical energy only.
- (9) At least three attempts shall be allowed.

The Cup is won outright by the entrant holding it for three consecutive years.

The competition will be held at the beginning of September. Actual date and flying ground will be announced in due course.

### Hampstead Section

Report by Official Observer (Mr. C. J. Burchell):—Members turned up in good numbers on Sunday, the 19th inst. Nearly every member present had a machine to fly. Messrs. Rippon, Moranne, Lansdown, Whelpton, Burchell, Burchell, Jun., and others made several flights and obtained plenty of practice in view of the forthcoming competitions. The enthusiasm of the Hampstead members of the L.A.M.A. appears to be increasing weekly. Great credit is due to the recently joined members of the Association who are building models, the workmanship comparing favourably with that of the older members.

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### SIDE-WINDS

SIR ROSS SMITH, acting no doubt on the results he obtained with the Smith aviation instruments he used during his Australian flight, is, we understand from S. Smith and Sons, having the Vickers "Viking" on which he will attempt the flight round the world fully equipped with Smiths' instruments. These will include the following: Revolution indicator, air-speed indicator, altimeter, oil and petrol pressure gauges, Cambridge radiator thermometers and Campbell-Bennett aperiodic compass.

And, of course, he will use K.L.G. sparking plugs.

"Jupiters" in the 0/400. Since being installed, these engines have flown for some 25 hours, and have proved extremely powerful and reliable. With a total load which brought the all-on weight of the machine up to 12,000 lbs., the climb to 3,000 ft. was accomplished in 6 mins. 15 secs. The engines are started by means of the Bristol gas-starter.

### AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations: cyl. = cylinder; I.C. = internal combustion; m. = motors. The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

#### APPLIED FOR IN 1920

Published March 30, 1922

- 32,173. C. S. COOKSON. Screw propellers. (176,066.)  
33,997. SPERRY GYROSCOPE CO. Gyroscopic compasses. (154,618.)  
34,467. E. F. BURRILL and C. M. BRUNE. Propelling and sustaining apparatus for aircraft. (154,929.)

#### APPLIED FOR IN 1921

Published March 30, 1922

- 1,667. A. L. FLATTUM. Aerial propellers. (157,956.)

If you require anything pertaining to aviation, study "FLIGHT'S" Buyers' Guide and Trade Directory, which appears in our advertisement pages each week (see pages iii and xiv).

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